ABSTRACT

A vehicular surface floor has a length and a width, made from a plurality of planks. Each plank has a length substantially equal to the length of the floor and a width that is less than the width of the floor. Each plank has first and second side surfaces and are arranged side by side so that a first side surface of one plank faces a second side surface of an adjacent plank; a joint region being formed at an area where the first side surface meets the second side surface. Each plank consists of at least two rows of boards, and each board consists of a plurality of segments joined end-to-end to one another by shaped coupling portions and side by side along a glue line; so that each of the at least two rows are longitudinally offset from an adjacent row, and a glue line of one row is offset from a glue line from an adjacent row.
WOODEN LAMINATED FLOOR PRODUCT TO IMPROVE STRENGTH, WATER PROTECTION AND FATIGUE RESISTANCE

FIELD OF THE INVENTION

[0001] The present invention relates to laminated product to improve the strength, water protection and the fatigue resistance on a laminated wooden cargo-carrying floor of a cargo-carrying body.

BACKGROUND OF THE INVENTION

[0002] Conventional wood flooring for over-the-road truck trailers and containers is normally manufactured with hardwoods such as oak, maple, birch, beech, etc. The green lumber used as a starting material in such manufacture is suitably dried in special drying chambers under controlled conditions. The dried lumber is then sawed into strips of rectangular cross-section and defective portions are eliminated by cross cutting the strips. After, with a double end matching or during the cross cutting process, hooks or knuckle-type joints are formed at the ends of the lumber strips. The joints are a simple mechanical coupling between the ends of opposing lumber strips without significant adhesive bonding at the joint itself. The relatively defect-free lumber strips are coated on their vertical sides or edges with an adhesive such as urea-melamine formaldehyde or polyvinyl acetate. The minimum length of the lumber strips is 12 inches, as requested by industry standard, and a maximum length of 6 to 7 feet, which is limited by the width of the double end matcher equipment which makes the desired profile of the joint. The uncurved edge-glue lumber strips are then assembled by hand on a conveyor by placing them side-by-side and one in front of other strips, which were previously assembled.

[0003] The manual assembly of the strips is a very important element and is essential to reach the desired mechanical properties of the floor and meet industrial requirements. In fact, the persons that assemble the strips must:

[0004] 1) minimise the number of joints by square foot; and

[0005] 2) maximise the space between joints in a way that it is equalised all over the wood floor.

[0006] These two elements maximise the floor’s mechanical support and its durability. The length of the lumber strips has an effect on the number of joint per square foot and the space between the joint. Applying heat and edge pressure to large sections of the assembled lumber strip in a press cures the adhesive thus forming a unitary panel.

[0007] At the output of the press, the cured laminated wood is cut to a desired length (up to about 60 feet) and width (about 6 to 18 inches) to form boards. The boards are then placed to a desired thickness and shiplaps and crusher beads are machined on the sides, such as shown in FIG. 1. A shiplap is a rectangular projecting ledge along the length on each side of a floorboard. A crusher bead is a small semi-circular projection running along the length on each side of a board and placed over or below a lip.

[0008] When the floorboards are assembled in a trailer such that the side edges of corresponding boards are squeezed together, the shiplaps of adjacent boards overlap to form a seam. The crusher beads provide spacing between adjacent boards and help in preventing buckling of the boards due to expansion of the board following absorption of water. Wood putty is applied at the joints on the top and bottom surfaces of the boards to fill any gaps.

[0009] Finally, the underside of the floorboards is coated with a polymeric substance termed as “undercoating” to provide moisture protection. The finished floorboards are assembled into a kit of about eight boards for installation in a trailer.

[0010] Normally, a kit consists of two boards with special shiplaps so that they will fit along the road and curb sides of a trailer. The other boards may be identical in design and they are placed between the road and curb sideboards. In some trailers, a metallic component such as a hat-channel may be placed between any two adjacent boards. The metallic component becomes part of the floor area. The boards adjacent the hat-channel have machined edges designed to mate with the flanges of the metallic component. All the boards are supported by thin-walled cross-members of I, C or hat sections, each having an upper flange or surface, which span the width of the trailer and are spaced along the length of the trailer. Each floorboard is secured to the cross-members by screws or other appropriate fasteners extending through the thickness of the board and the upper flanges of the cross-members.

[0011] Hardwood-based laminated wood flooring is popularly used in truck trailers since it offers many advantages. The surface characteristics of hardwoods such as high wear resistance and slip resistance are most desirable. The strength and stiffness of the flooring is important for efficient and safe transfer of the applied loads to the cross-members of the trailer. The shock resistance of wood is useful to withstand any sudden dropping of heavy cargo on the floor. Nailing holding capability and the ability to absorb small amounts of water, oil or grease without significantly affecting slip resistance are yet additional favourable properties of hardwood flooring.

[0012] Although conventional wood flooring has many desirable features, it also suffers from certain disadvantages. One of the main problems is the effect of the end of each lumber strips on the strength and durability of the floor.

[0013] It is well known in the flooring industry that the joint between two end lumber strips is the structural weakness point of a laminated floor for two reasons.

[0014] First, the joint reduces the capacity of the floor to react properly to the dynamic action of a moving lift truck placing or removing heavy cargo into the trailer. A lift truck is often used on the trailer floor to load and unload cargo. A large amount of the weight of the lift truck and the cargo is transferred to the floor through the wheels of the front axle of the lift truck due to the momentary raising of the rear axle when the lift truck is dynamically placing or removing heavy cargo on the floor. The dynamic action of a moving lift truck placing heavy cargo on the trailer floor places a severe stress concentration on the floor and some of the cross-members. Bending of the floor between two adjacent cross-members due to any applied load on the top of the floor has a tendency to open the hook joints and enlarge the gaps. The effect of repeated lift truck operations on the conventional wood floor causes considerable fatigue dam-
age including: de-lamination of the edge glued lumber strips near the joints leading to the “pop-out” of the lumber strips on the underside; crack initiation and propagation in the wood strips on the underside of the floor due to tensile stresses; and cracking of edge glue lines due to shearing, transverse bending and twisting of the floor.

[0015] Second, the joint represents a weak area of protection against water coming from the road. Capillarity and the tendency of the end grain of wood to absorb and store water over time eventually creates a problem of water leaks into the trailer and a degradation of the structural integrity surrounding the joint area. Also, because of the way that conventional floors are made, when de-laminating occurs, the cracks will penetrate through the laminated floor creating a weak area where the water can enter. The combination of moisture attack and fatigue damage to the wood floor affects its performance thus necessitating its repair or replacement. In some cases, catastrophic structural failure of the trailer floor system may occur leading to the unacceptable injury to working personnel and damage to machinery.

[0016] In the past decade, and still today, the research and development efforts to improve the disadvantages of conventional floors are mainly focused on the use of new materials such as plastic, fiberglass, etc., and on the interaction with wood to create new composite floors.

[0017] The idea of using plastic, steel, fiber carbon, kevlar, fiberglass and other material to reinforce wooden structure is not new and has been studied by many. More recently, Padmanabhan U.S. Pat. No. 5,928,735 and Tunis U.S. Pat. No. 6,601,357 propose solutions in the specific field of laminated trailer floor.

[0018] Padmanabhan applies a reinforced thermoplastic ply to the entire bottom of the floor. Because reinforced ply increases the strength and stiffness of the trailer floor, the hardwood portion of the floor can be thinner. The result is a stronger and lighter trailer floor. The reinforced ply also provides a water impervious layer protecting the entire bottom part of the floor from moisture coming from the road.

[0019] Tunis provides a solution for moisture protection only. The thermoplastic ply is not reinforced and has as its sole purpose the protection of the floor from the attack of water spray and moisture over time. The thermoplastic ply covers the entire bottom surface of the floor.

[0020] Others have taken a different approach and have proposed solutions improving some aspect of the laminated wood floor without adding any composite material, but by improving the manufacturing method or technique. In U.S. Pat. No. 6,843,877 (Risi) and in U.S. Pat. No. 6,957,675 (Risi) there is proposed a new machine and manufacturing method which uses a finger joint type end stick design to improve the durability and the moisture resistance of the laminated floor. The present invention takes that the same avenue creating innovative solutions where an improvement of the strength can be achieved without using composite materials but only by using more efficiently the actual techniques of manufacturing and the characteristics of the raw material itself.

SUMMARY OF THE INVENTION

[0021] The present invention is a new product to improve the strength, fatigue resistance and provide moisture resis-
FIG. 2 is a perspective cross section of a conventional wood floor according to a preferred embodiment of the invention; and

FIG. 3 is a perspective view of a floor, including an undercoat layer.

DESCRIPTION OF A PREFERRED EMBODIMENT OF THE INVENTION

Referring now to FIG. 2, there is shown a perspective cross-section of a wood plank 1. A plurality of such wood planks are arranged side by side to form a floor 10.

Each wood plank 1 is made of at least two layers of boards 100. Each board is made of a plurality of strips 101, each strip being joined end-to-end at a joint region 103, and each set of strips being joined side by side along a glue line 105.

In a preferred embodiment of the invention, the strips are hardwood boards, and the hardwood is further preferably selected from the group consisting of oak, maple, birch, beach, and larch.

In accordance with a preferred embodiment of the invention, one layer 100 is longitudinally offset from another layer 100, such that the glue lines of one board are offset from the glue lines of another board, as shown in FIG. 2. Although only two layers are shown in FIG. 2, it will be understood that more layers can be used depending on the thickness of the strips, and on the desired overall thickness of the floor 10.

In the case of FIG. 2, the offsetting of one layer with respect to another automatically creates the shiplap joint, leaving only the crusher bead to be made.

It will further be appreciated that the plank of FIG. 2 can be made as in the prior art, that is a full thickness plank, which is then split in two and glued together, but offset, along glue line 106. Furthermore, one of the two halves is rotated front to back (180°), so that joints do not face each other. Also, if more than one layer is used, for example three, then instead of a shiplap joint, a tongue-and-groove system can be used.

Furthermore, the butt end joints of the sticks of the bottom layer do not face completely the butt end joints of the sticks of the upper part of the floor.

As is the case of convention floors, the floor of the present invention can be further provided with an undercoating. The undercoating can be an un-reinforced polymer, a paint or a fiber-reinforced polymer. The undercoating further can cover substantially 100 percent of said bottom surface or less (for example at areas where it is more important), and partially or substantially cover both side surfaces of said floor.

It should be pointed out that the lamination of the top to the bottom part of the floor can be done for other wooden floors, such as those used in the flat bed industry. Those wooden floors are typically not laminated and are made with solid wooden planks of 8 inches wide by 8 to 12 feet long, with different thicknesses (usually 1/4 or 1 1/2 inches thick). After the board is planed, the plank has a ship lap in both sides, as in conventional laminated floor, with a final thickness of 1 ½ or 1 5/16 (1 3/8).

The new product according to the present invention offers many advantages as follows:

- It reduces the quantity of the raw material needed to produce the same square footage; usually, conventional floors are made with 14 sticks whereas the new product is made with only 13 sticks.
- Depending on the way the new product is produced, it may increase the productivity of manufacturing;
- There is no way for the water to go through the floor because there are no glue lines or butt end joints which go straight from the bottom to the top;
- Because of the way it is designed, even if delamination does occur between sticks on one of the layers, it will be difficult for the water to go through the floor;
- Because there are no joints going straight through the floor, the negative effect of the conventional joint is decreased, which in turn increases the fatigue resistance when the laminated floor is under stress during the forklift passages on the floor.
- The product according to the present invention has better durability characteristics over the traditional laminated wooden floor used in the industry and also offers a more economic alternative to composite floors using reinforced ply like fibreglass, which are very expensive.

Although the present invention has been explained hereinabove by way of a preferred embodiment thereof, it should be pointed out that any modifications to this preferred embodiment within the scope of the appended claims is not deemed to alter or change the nature and scope of the present invention.

1. A vehicular surface floor having a longitudinal length and a lateral width, said vehicular surface floor comprising:
   a) a plurality of wood planks extending longitudinally up to a length substantially equal to the longitudinal length of said floor, each plank having a top surface, a bottom surface opposite said top surface, and a first and second side surfaces extending between said top surface and said bottom surface, where said plank has a width that is less than the lateral width of said floor, said floor being formed of said plurality of planks arranged side by side, each plank being formed of at least two rows of a plurality of boards, each board being formed of a plurality of segments joined end-to-end to one another by shaped coupling portions and side by side along a glue line, each of said at least two rows being longitudinally offset from an adjacent row, so that a glue line of one row is offset from a glue line from an adjacent row; and
   b) said plurality of planks being arranged side by side such that at least one of said first and said second side surfaces of each of said planks faces one of said second or first side surfaces of adjacent planks to form the floor, a joint region being formed at locations at which said first side surface faces said second side surface of adjacent planks.

2. A vehicular surface floor according to claim 1, wherein said plurality of wood boards are hardwood boards.
3. A vehicular surface floor according to claim 2, wherein said hardwood is selected from the group consisting of oak, maple, birch, beach, and larch.

4. A vehicular surface floor according to claim 1, wherein said floor is further provided with an undercoating.

5. A vehicular surface floor according to claim 4, wherein said undercoating is an unreinforced polymer, a paint or a fiber-reinforced polymer.

6. A vehicular surface floor according to claim 1, wherein said undercoating covers both substantially 100 percent of said bottom surface, and partially or substantially covers both side surfaces of said floor.

7. A vehicular surface floor according to claim 1 wherein said first side surface is provided with an upper lip portion, said second side surface is provided with a lower lip portion, and said first side surface of one of said planks which faces said second side surface of an adjacent plank forms a ship lap joint in which said upper lip portion at least partially overlies said lower lip portion.

8. A vehicular surface floor according to claim 7, wherein each of said planks consists of only two rows of boards, and said ship lap joint is automatically formed by offsetting a first row of boards from a second adjacent row of boards.

9. A vehicular surface floor having a longitudinal length and a lateral width, said floor comprising:

   a plurality of planks, each plank having a length substantially equal to said length of said floor and a width that is less than said width of said floor, each plank having first and second side surface, said planks being arranged side by side so that a first side surface of one plank faces a second side surface of an adjacent plank, a joint region being formed at an area where said first side surface meets said second side surface, wherein:

   each plank consists of at least two rows of boards.

   each board consists of a plurality of segments joined end-to-end to one another by shaped coupling portions and side by side along a glue line;

   each of said at least two rows are longitudinally offset from an adjacent row, so that a glue line of one row is offset from a glue line from an adjacent row.

10. A vehicular surface floor according to claim 9, wherein said plurality of wood boards are hardwood boards.

11. A vehicular surface floor according to claim 10, wherein said hardwood is selected from the group consisting of oak, maple, birch, beach, and larch.

12. A vehicular surface floor according to claim 9, wherein said floor is further provided with an undercoating.

13. A vehicular surface floor according to claim 12, wherein said undercoating is an unreinforced polymer, a paint or a fiber-reinforced polymer.

14. A vehicular surface floor according to claim 9, wherein said undercoating covers both substantially 100 percent of said bottom surface, and partially or substantially covers both side surfaces of said floor.

15. A vehicular surface floor according to claim 9, wherein said first side surface is provided with an upper lip portion, said second side surface is provided with a lower lip portion, and said first side surface of one of said planks which faces said second side surface of an adjacent plank forms a ship lap joint in which said upper lip portion at least partially overlies said lower lip portion.

16. A vehicular surface floor according to claim 15, wherein each of said planks consist of only two rows of boards, and said ship lap joint is automatically formed by offsetting a first row of boards from a second adjacent row of boards.